

**FLEXIBLE  
PAVEMENT  
DISTRESS  
IDENTIFICATION MANUAL**





PAVEMENT MANAGEMENT SYSTEM

# **Flexible Pavement Distress Identification Manual**

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# Table of Contents

## CHAPTER 1

Objective .....	1
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## CHAPTER 2

Flexible Pavement Distress .....	3
Fatigue Cracking .....	
Type A .....	4
Type B .....	6
Non-Wheelpath Longitudinal Cracking .....	8
Transverse Cracking .....	10
Block Cracking .....	
Type A .....	12
Type B .....	14
Type C .....	16
Surface Deformation .....	
Rutting .....	18
Patching .....	20
Surface Defects .....	
Flushing .....	22
Raveling .....	24

## CHAPTER 3

Lane Identification Numbering and Rating Area Layout .....	27
Lane Identification and Numbering .....	28
Rating Area Layout .....	31

## CHAPTER 4

The Flexible Pavement Condition Rating Form .....	35
Condition Rating Form Preprinted Information .....	37
Condition Rating Form's Column Headings and Data Entry Areas:	
Preprinted Information Columns .....	38
Data Entry Columns .....	40

## CHAPTER 5

Tools of the Trade .....	51
Crack Width Gauge .....	52

## CHAPTER 6

Definitions of Key Terms .....	53
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## CHAPTER 7

Pavement Condition Photographs .....	57
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# Objective

*The Flexible Pavement Distress Identification Manual has been developed to provide guidelines for collecting accurate, consistent, and repeatable pavement condition data.*

The pavement condition data, along with ride quality, and friction measurements are used to accomplish the following objectives:

- prioritize projects
- monitor pavement performance
- identify the status of the existing system
- estimate the needs for future funding

In order to accomplish the above objectives successfully, it is essential that data is collected properly, accurately, and consistently.

This manual describes types and causes of flexible pavement distress and how to identify them. It discusses lane identification, how to lay out the rating area, tools used during the rating process, and the definition of key terms. Sample forms and explanations for recording and reporting the data are also included in this manual.



## Flexible Pavement Distress

*To have an effective Pavement Management System we must be able to identify the different types of distresses that can occur on an asphalt concrete surface.*

Flexible pavement distresses are grouped into one of the following categories:

- Cracking
- Surface Deformation
- Patching
- Surface Defects

Table 1 summarizes the various types of distresses, units of measurement and whether or not the distress has defined levels of severity.

**Table 1. Asphalt Concrete Surface Pavement Distress Types**

Distress Type	Units of Measure	Defined Severity Levels
Cracking:		
Fatigue Cracking:		
Type A	Linear Feet	Yes
Type B	Square Feet	Yes
Non-Wheelpath Longitudinal Cracking	Linear Feet	Yes
Transverse Cracking	Linear Feet	Yes
Block Cracking:		
Type A	Linear Feet	Yes
Type B	Square Feet	Yes
Type C	Square Feet	Yes
Surface Deformation:		
Rutting	Inches	Yes
Patching:		
Patch	Square Feet	No
Surface Defects:		
Flushing	Photo Identification	Yes
Raveling	Photo Identification	Yes

# FATIGUE CRACKING

## TYPE A

### Description

This type of cracking is *located in one or both wheelpath(s)* and is described as a *single longitudinal* crack approximately parallel to the centerline.

### Causes

This distress is caused by repeated traffic loadings on the pavement surface and is the first sign of pavement fatigue. These cracks begin at the bottom of the paved surface and slowly work their way to the top of the surface. Without the full structural support of the asphalt layer, traffic loadings are transmitted to the base layer more directly and with more impact. This will eventually cause the base section to weaken and “move”. With continued traffic loadings, the longitudinal cracks in the wheelpath(s) will multiply and interconnect, thus progressing into Type B Fatigue Cracking. An unstable base, inadequate drainage, insufficient pavement thickness, degradation and/or stripping in the asphalt concrete combined with the traffic loadings will accelerate this type of distress.

### Severity

Severity is defined as the *average crack width* of this type of cracking throughout the rating area.

### Method of Measurement

Using the “crack width gauge”, *take a minimum of six crack width measurements* of this crack type throughout the rating area. Average those measurements and record that value in *column number 9 (SEV)* of the condition rating form. Individual measurements should be “rounded” to the nearest tick-mark on the gauge. If the crack widths are narrower than one tick-mark on the gauge, record the severity as “1”.

### Extent

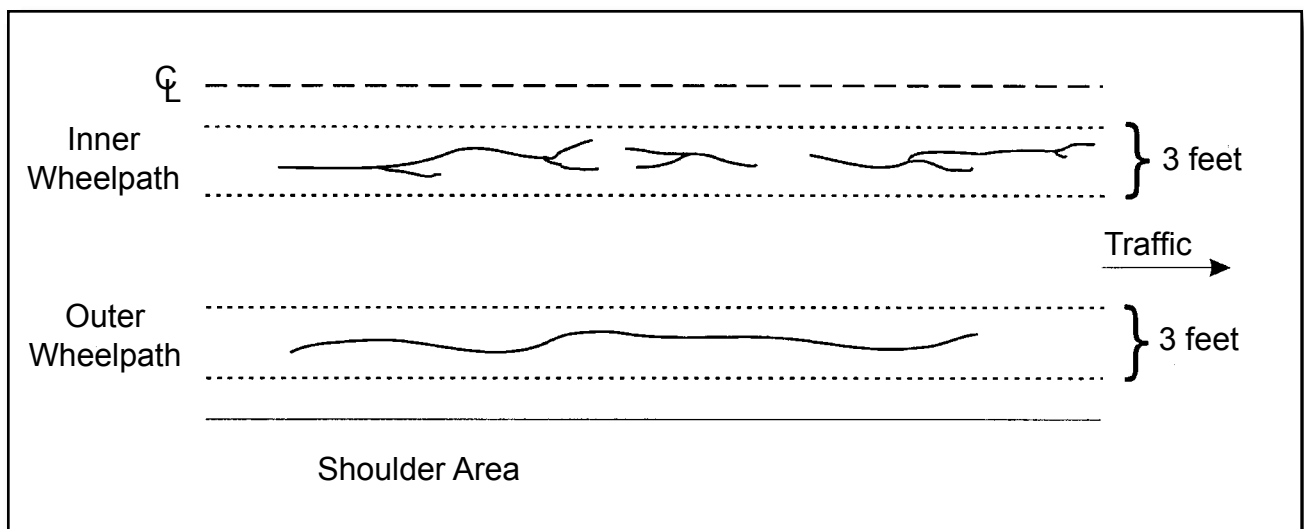
Extent is defined as the *total linear feet* of this type of cracking in the *wheelpath* area of the rating area.

### Method of Measurement

Using a Roll-A-Tape or other distance-measuring instrument, *measure the lengths of all the cracks of this type* throughout the rating area. Sum those measurements and record the total in *column number 10 (EXT)* of the condition rating form. The maximum value possible is 200 feet (100-foot rating area length x 2 wheelpaths).



*Figure 1. Example of Fatigue Cracking, Type A*



*Figure 1A. Fatigue Cracking, Type A*

# FATIGUE CRACKING

## TYPE B

### Description

This type of cracking is *located in one or both wheelpath(s)* and is described as a *series of parallel or interconnected longitudinal* cracks. When interconnected, these cracks form a pattern that resembles an alligator's skin.

### Causes

This distress is the natural progression of Type A Fatigue Cracking. Like Type A Fatigue Cracking, it is caused by repeated traffic loadings on the pavement surface. The longitudinal cracks in the wheelpath(s) will now begin to spall (pieces begin to break away from the crack edges) causing a further weakening of the pavement surface. Traffic loads now weigh heavier on the base layer causing the base section to weaken and begin to deform.

### Severity

Severity is defined as the *average crack width* of this type of cracking throughout the rating area.

### Method of Measurement

Using the "crack width gauge", *take a minimum of six crack width measurements* of this crack type throughout the rating area. Average those measurements and record that value in *column number 9 (SEV)* of the condition rating form. Individual measurements should be "rounded" to the nearest tick-mark on the gauge. If the crack widths are narrower than one tick-mark on the gauge, record the severity as "1".

### Extent

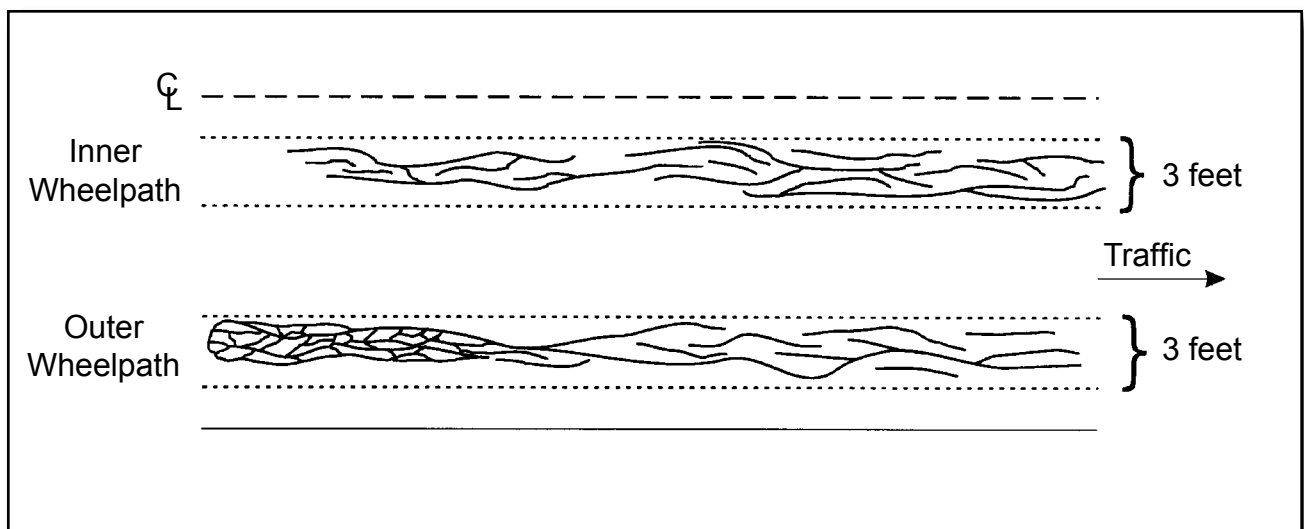
Extent is defined as the *total square feet* of this type of cracking in the *wheelpath* area of the rating area.

### Method of Measurement

Using a Roll-A-Tape or other distance-measuring instrument, *measure the length and width of each section of this type cracking* throughout the rating area. Calculate the area in square feet of each distressed section, sum the areas and record the total in *column number 10 (EXT)* of the condition rating form. The maximum value possible is 600 square feet (100 foot rating area length x 3 foot wheelpath width x 2 wheelpaths).



*Figure 2. Example of Fatigue Cracking, Type B*



*Figure 2A. Fatigue Cracking, Type B*

# NON-WHEELPATH LONGITUDINAL CRACKING

## Description

This type of cracking is *located outside of the wheelpaths* and is described as longitudinal cracks in the pavement surface approximately parallel to the centerline of the roadway.

## Causes

Possible causes of this type of distress include deformation of the pavement surface or the stretching and tearing of the pavement surface. Cracks caused from either of these begin at the surface and propagate downward. This type of crack may also occur at poorly constructed lane joints or be reflective and propagate from an underlying joint or crack. This type of distress is *not* load related and *not* located in the wheelpaths.

## Severity

Severity is defined as the *average crack width* of this type of cracking throughout the rating area.

## Method of Measurement

Using the “crack width gauge”, *take a minimum of six crack width measurements* of this crack type throughout the rating area. Average those measurements and record that value in *column number 11 (SEV)* of the condition rating form. Individual measurements should be "rounded" to the nearest tick-mark on your gauge. If the crack widths are narrower than one tick-mark on the gauge, record the severity as “1”.

## Extent

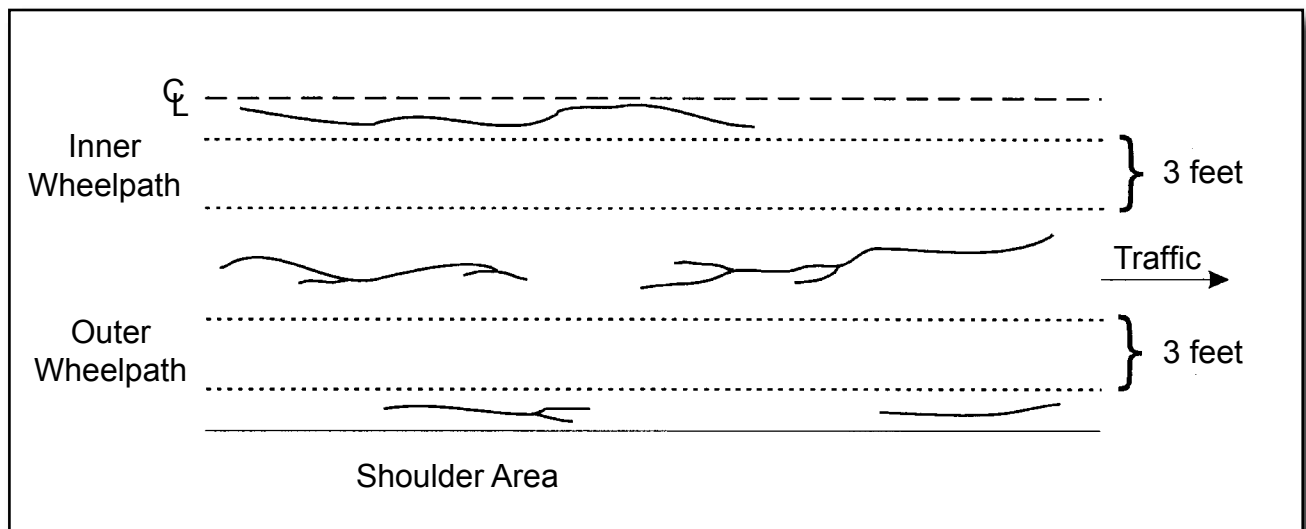
Extent is defined as the *total linear feet* of this type of cracking throughout the rating area.

## Method of Measurement

Using a Roll-A-Tape or other distance measuring instrument, *measure the lengths of all of the cracks of this type* throughout the rating area. Sum those measurements and record the total in *column number 12 (EXT)* of the condition rating form. The maximum value possible is 300 feet (100 feet rating area length x 3 non wheelpath areas).



*Figure 3. Example of Non-Wheelpath Longitudinal Cracking*



*Figure 3A. Non-Wheelpath Longitudinal Cracking*

# TRANSVERSE CRACKING

## Description

Cracks in the pavement surface approximately *perpendicular to the centerline of the roadway*. These cracks can begin anywhere across the width of the pavement and may or may not encompass the full width of the roadway.

## Causes

This type of cracking is primarily caused by expansion and contraction of the pavement binder due to temperature changes. Other causes include:

- Age Hardening
- Reflection cracking from Portland Cement Concrete Pavement (PCCP) joints below
- Reflection cracking from transverse cracks below

## Severity

Severity is defined as the *average crack width* of this type of cracking throughout the rating area.

## Method of Measurement

Using the “crack width gauge”, *take a minimum of six crack width measurements* of this crack type throughout the rating area. Average those measurements and record that value in *column number 13 (SEV)* of the condition rating form. Individual measurements should be “rounded” to the nearest tick-mark on the gauge. If the crack widths are narrower than one tick-mark on the gauge, record the severity as “1”.

## Extent

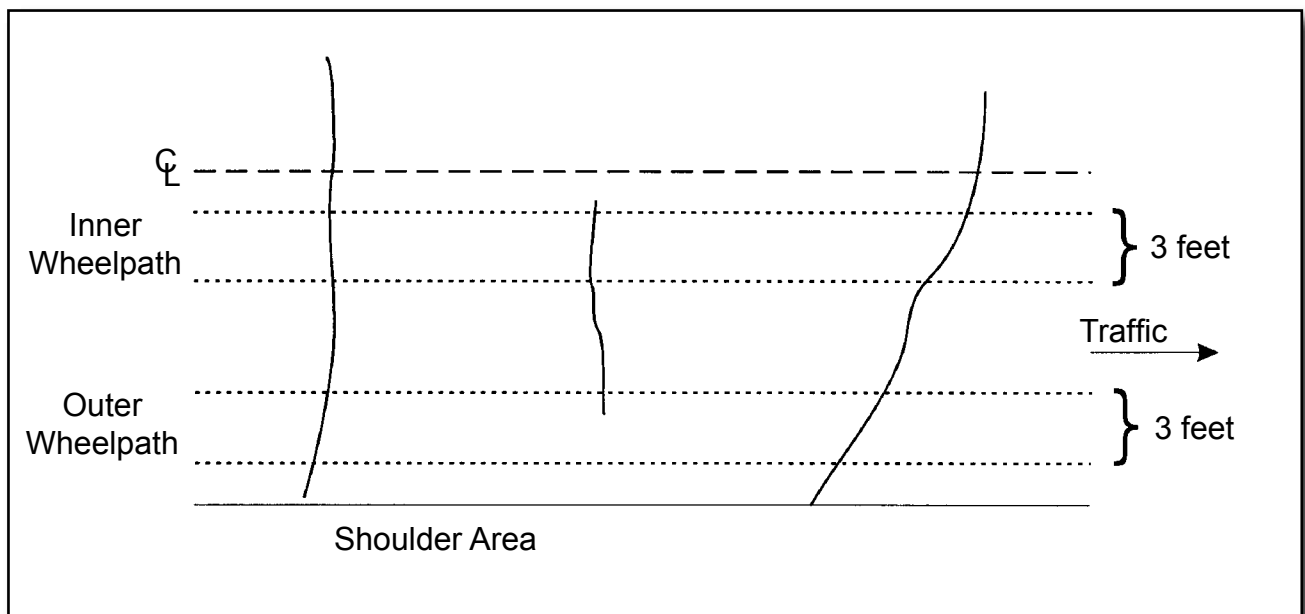
Extent is defined as the *total linear feet* of this type of cracking throughout the rating area.

## Method of Measurement

Using a Roll-A-Tape or other distance measuring instrument, *measure the lengths of all the cracks of this type* throughout the rating area. Sum those measurements and record the total in *column number 14 (EXT)* of the condition rating form. The maximum possible value is 210 feet (21 maximum cracks x 10 feet wide rating area – based on one crack every 5 feet).



*Figure 4. Example of Transverse Cracking*



*Figure 4A. Transverse Cracking*

# BLOCK CRACKING

## TYPE A

### Description

A network of *intersecting longitudinal and transverse cracks* which form a series of large blocks. The blocks formed by these cracks are approximately rectangular in shape and are *larger than 5 feet on each side*. Distressed areas with blocks smaller than this should be recorded as either Block Cracking Type B or Block Cracking Type C.

### Causes

This type of Block Cracking is a combination of Transverse and Non-Wheelpath Longitudinal Cracking. For a description of the possible causes, see the section pertaining to the specific types present.

### Severity

Severity is defined as the *average crack width* of this type of cracking throughout the rating area.

### Method of Measurement

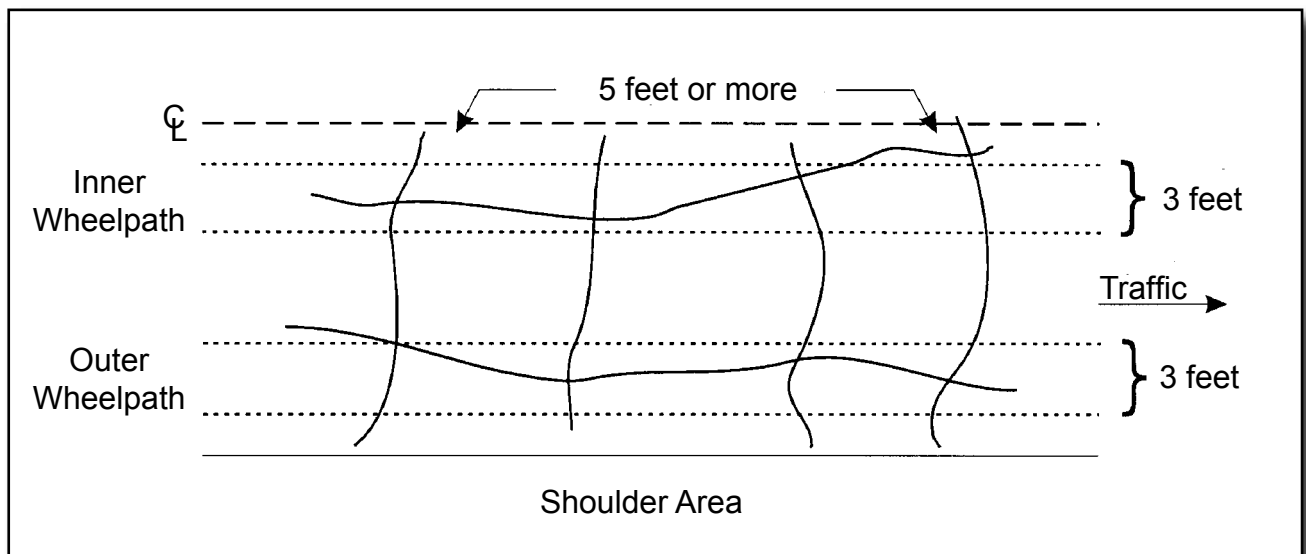
Using the “crack width gauge”, *take a minimum of six crack width measurements* of this crack type throughout the rating area. Average those measurements and record that value in *column number 16 (SEV)* of the condition rating form. Individual measurements should be "rounded" to the nearest tick-mark on the gauge. If the crack widths are narrower than one tick-mark on the gauge, record the severity as “1”.

### Extent

Extent is defined as the *total linear feet* of this type of cracking throughout the rating area.

### Method of Measurement

Using a Roll-A-Tape or other distance measuring instrument, *measure the lengths of all the cracks of this type* throughout the rating area. Sum the lengths and record the total in *column number 17 (EXT)* of the condition rating form. The maximum value possible is 510 linear feet (300 feet of Non Wheelpath Longitudinal Cracking + 210 feet of Transverse Cracking).



*Figure 5A. Block Cracking, Type A*

# BLOCK CRACKING

## TYPE B

### Description

A network of *interconnected cracks that form a series of irregular shaped polygons*, usually with sharp corners or angles. This type of distress is categorized by the size of the polygons. Shapes of this type range in size from *1 foot x 1 foot to 5 feet x 5 feet*. This pattern resembles “chicken wire” in appearance and can cover large portions or the entire surface.

### Causes

This distress is caused by age hardening and shrinkage of the pavement surface. Although traffic loading is not the primary cause of this type of distress, continued loading on the brittle surface will accelerate this distress and break the larger pieces into smaller pieces. When the pieces become smaller than 1 foot x 1 foot, the distress is categorized as Type C Block Cracking.

### Severity

Severity is defined as the *average crack width* of this type of cracking throughout the rating area.

### Method of Measurement

Using the “crack width gauge”, *take a minimum of six crack width measurements* of this crack type throughout the rating area. Average those measurements and record that value in *column number 16 (SEV)* of the condition rating form. Individual measurements should be “rounded” to the nearest tick-mark on the gauge. If the crack widths are narrower than one tick-mark on the gauge, record the severity as “1”.

### Extent

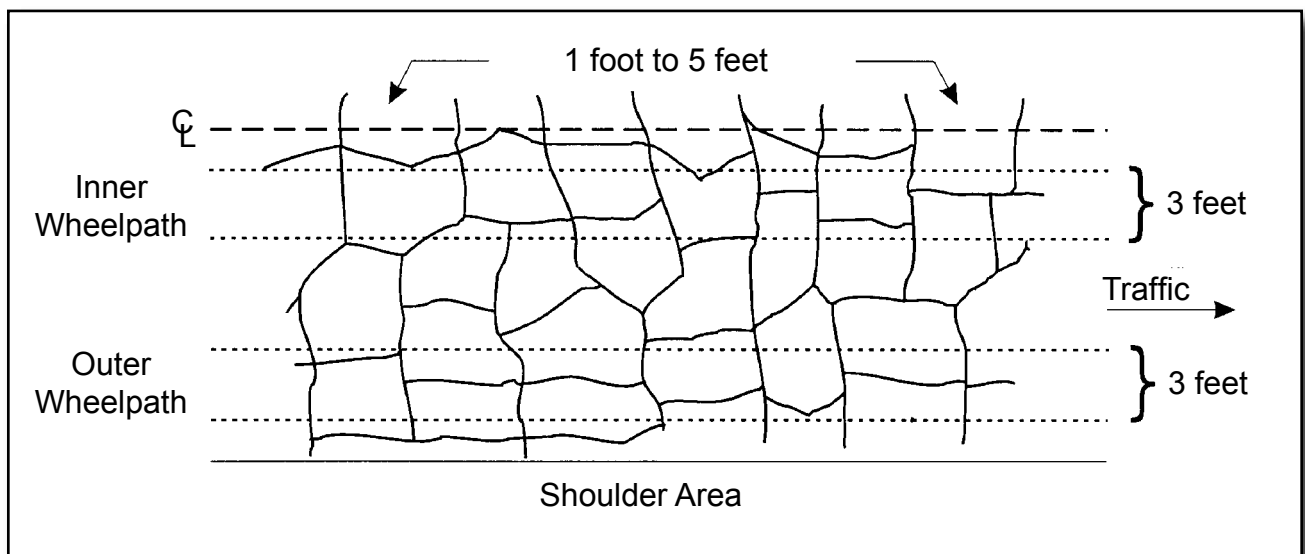
Extent is defined as the *total square feet* of this type of cracking throughout the rating area.

### Method of Measurement

Using a Roll-A-Tape or other distance measuring instrument, *measure the length and width of each section containing this type of cracking* throughout the rating area. Calculate the area in square feet of each distressed section, sum the areas and record the total in *column number 17 (EXT)* of the rating form. The maximum value possible is 1000 square feet (100 foot rating area length x 10 foot rating area width).



*Figure 6. Example of Block Cracking, Type B*



*Figure 6A. Block Cracking, Type B*

# BLOCK CRACKING

## TYPE C

### Description

A network of *interconnected cracks that form a series of small irregular shaped polygons*, usually with sharp corners or angles. Shapes categorized by this type of cracking are *smaller than 1 foot x 1 foot*. This pattern resembles “chicken wire” in appearance and can cover large portions or the entire surface.

### Causes

This distress is caused by age hardening and shrinkage of the pavement surface and accelerated by traffic loadings. This type of distress progresses naturally from Block Cracking Type B as traffic loadings break the larger Type B polygons into pieces smaller than 1 foot x 1 foot. If not properly treated, continued traffic loading will cause spalling and pot holes.

### Severity

Severity is defined as the *average crack width* of this type of cracking throughout the rating area.

### Method of Measurement

Using the “crack width gauge,” *take a minimum of six crack width measurements* of this crack type throughout the rating area. Average those measurements and record that value in *column number 16 (SEV)* of the condition rating form. Individual measurements should be “rounded” to the nearest tick-mark on the gauge.

### Extent

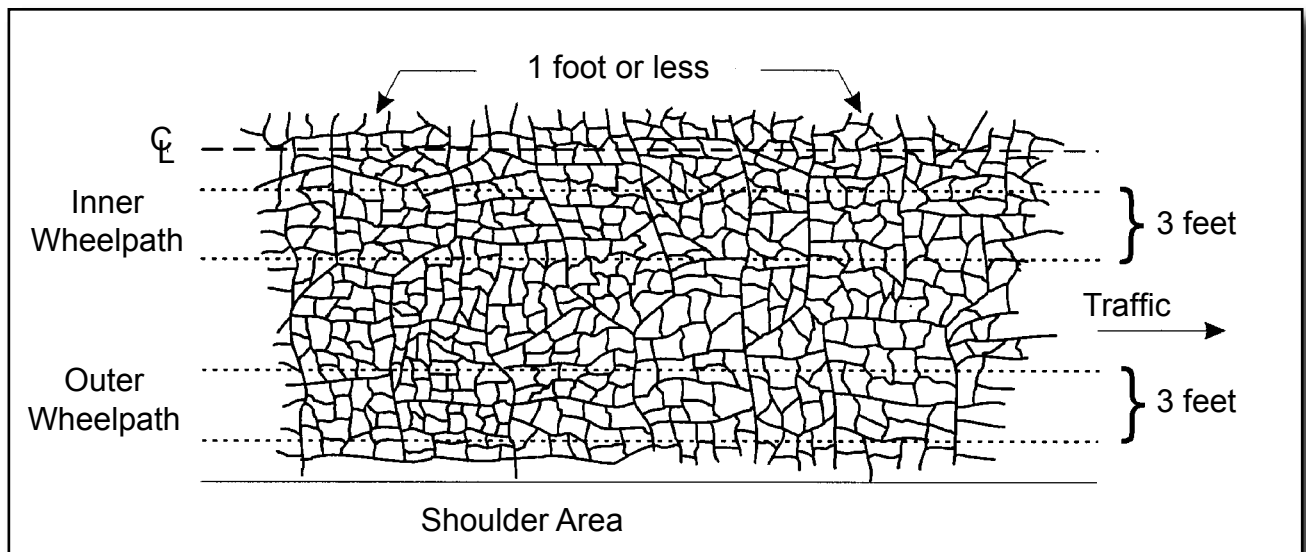
Extent is defined as the *total square feet* of this type of cracking throughout the rating area.

### Method of Measurement

Using a Roll-A-Tape or other distance measuring instrument, *measure the length and width of each section containing this type of cracking* throughout the rating area. Calculate the area in square feet of each distressed section, sum the areas and record the total in *column number 17 (EXT)* of the condition rating form. The maximum value possible is 1000 square feet (100 foot rating area length x 10 foot rating area width).



*Figure 7. Example of Block Cracking, Type C*



*Figure 7A. Block Cracking, Type C*

# RUTTING

## Description

Ruts are described as *longitudinal surface depressions in the wheelpaths*. Pavement uplift (shoving) may occur along the sides of the rut.

## Causes

Rutting is a load related failure of the pavement or the result of pavement densification or wear. Any one, or combination of the following, may cause rutting:

- Soft pavement due to poor quality mix
- Insufficient pavement thickness
- Unstable base
- Insufficient compaction during construction
- Stripping
- Pavement wear or loss due to abrasive action of traffic

## Severity Levels

Rutting is considered severe if it is one-half (1/2) inch or deeper. **Only in this case will the rater record that rutting exists on the condition rating form.**

## Method of Measurement

The raters *do not* measure the depth of observed rutting. If rutting exists the rater is to make a visual estimate of the depth. If the depth is determined to be 1/2 inch or deeper the rater will record a “Y”, for Yes, in *column number 19* of the condition rating form. If no rutting exists or is determined to be less than 1/2 inch, the rater should record an “N”, for No, in *column number 19* of the condition rating form.



*Figure 8. Example of Rutting*



*Figure 9. Example of Rutting and Shoving*

# PATCHING

## Description

A portion of the *pavement surface that has been removed and replaced or overlaid as a temporary correction* to damaged pavement. These repairs may include such treatments as spot patching, blade patching or any other type of *repair* that does not constitute a rehabilitative or reconstructive measure (i.e. chip seals, inlays, overlays, or reconstruction etc.).

## Causes

Inconsistent pavement structural section, poor quality materials, inadequate drainage facilities, or unusual traffic patterns can cause premature pavement failure. Typically, the distressed area is either removed and replaced or overlaid by maintenance forces.

## Severity Levels

No severity levels are recorded for patches.

## Method of Measurement

Using a Roll-A-Tape or other distance measuring instrument, *measure the length and width of each patch* located in the rating area. Calculate the area in square feet of each patch, sum the areas and record the total in *column number 20* of the condition rating form. The maximum value possible is 1000 square feet (100 foot rating area length x 10 foot rating area width).

Note: Include any distress within the patch on the rating form.



*Figure 10. Example of Patching*

# FLUSHING

## Description

Excess bituminous *binder migrating to the pavement surface* appearing as a shiny, glass-like, reflective surface that may be tacky to the touch. Usually found in the wheelpaths.

## Causes

The primary cause of flushing is excessive asphalt binder in the pavement mix. It may also occur if too much emulsified asphalt is applied with a chip seal. Summer heat and traffic loading cause the pavement to soften and forces the heavier aggregate downward. This, in turn, forces excess asphaltic oil in the pavement mix to migrate to the surface. The result is a shiny and slick surface, predominately in the wheelpaths, which presents a safety problem in wet weather.

## Severity Levels

Severity levels can be defined as *Low, Moderate or Severe* and correspond to the photographs in **Figures 11, 12, and 13**, below, which best depict the amount of flushing present.

## Method of Measurement

No direct measurements are taken for flushing. The rater determines the severity of flushing by comparing the roadway condition to the photos in **Figures 11, 12, and 13** then records an “L” for Low, an “M” for Moderate or an “S” for Severe in *column number 21* of the condition rating form. If no flushing is present, the column should remain blank.



*Figure 11. Low Flushing*



*Figure 12. Moderate Flushing*



# RAVELING

## Description

Raveling is the deterioration of the pavement surface associated with the *dislodging of aggregate* particles and asphalt binder through the action of traffic.

## Causes

The effects of sun, weather, age, and lack of proper maintenance causes the asphalt binder to dry, become brittle and break away from the surface aggregate. This process weakens the surface structure of the roadway, and as traffic moves along the roadway, the aggregate becomes dislodged from the pavement. Continuous traffic gouges out even more of the weakened surface aggregate and promotes more raveling. Poor quality mixtures can also be a contributing factor to raveling.

## Severity Levels

Severity levels can be defined as *Low, Moderate, or Severe* and correspond to the photographs in **Figures 14, 15, and 16**, below, which best depict the amount of raveling present.

## Method of Measurement

No direct measurements are taken for raveling. The rater determines the severity of raveling by comparing the roadway condition to the photos in **Figures 14, 15, and 16** then records an “L” for Low, an “M” for Moderate or an “S” for Severe in *column number 22* of the condition rating form. If no raveling is present, the column should remain blank.



*Figure 14. Low Raveling*



*Figure 15 Moderate Raveling*



*Figure 16 Severe Raveling*



## Lane Identification & Numbering, and Rating Area Layout

*To ensure the data collection efforts can be repeated from year to year it is important that everyone understand the method of lane identification and numbering and how to layout a rating area.*

# LANE IDENTIFICATION AND NUMBERING

In order to properly locate and identify a pavement rating area, it is important to understand lane layout and identification.

The lane numbering system is very simple. Count the travel lanes from the roadway centerline outward toward the shoulder area. The number, assigned to each lane counted is that lane's identification number, with lane #1 being closest to the centerline (refer to Figures 17 and 18).

The lane that is to be rated is preprinted on the condition rating form in column number 5, "TEST LANE". If the preprinted lane number does not correspond to the rated lane number, the rater should correct the form by crossing out the existing number, entering the actual rated lane number, and write a comment explaining the change in the space between rating sections on the condition rating form.

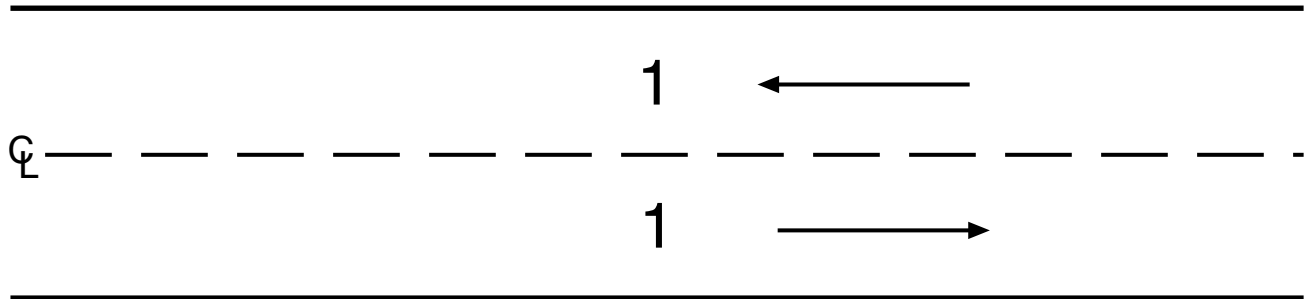
**Right and left turn lanes** are **not** included in lane numbering as they do not carry through traffic and they are **not** counted as lanes for the Pavement Management System (PMS). **Two-way left turn lanes** (sometimes referred to as painted median areas) are not considered as "mainline or through lanes" and, therefore, are also **not** counted as lanes. **Shoulders and parking lanes** are **not** counted or rated.

**Truck climbing lanes** are located in some areas. These lanes are constructed to compensate for the slower speeds of uphill truck traffic. They allow unimpeded traffic movement around the slower trucks and keep the traffic flowing smoothly. Truck climbing lanes are only numbered when their length is 1/2 mile or more.

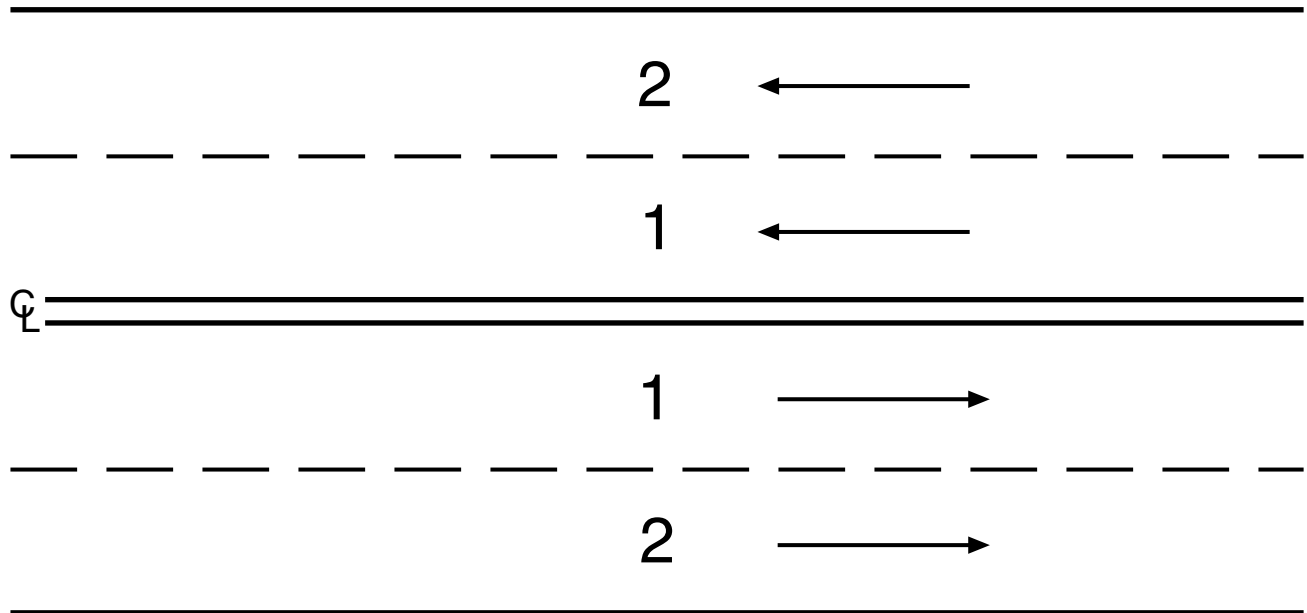
**Acceleration and/or deceleration lanes** are located in many urban areas, primarily along the Interstate system. These lanes allow the safe merging and diverging of traffic to and from the mainline. As with the truck climbing lanes, the acceleration/deceleration lanes are only numbered when their length is 1/2 mile or more.

Figure 17. Lane Numbering Examples

**1. 2-Lane Roadway**



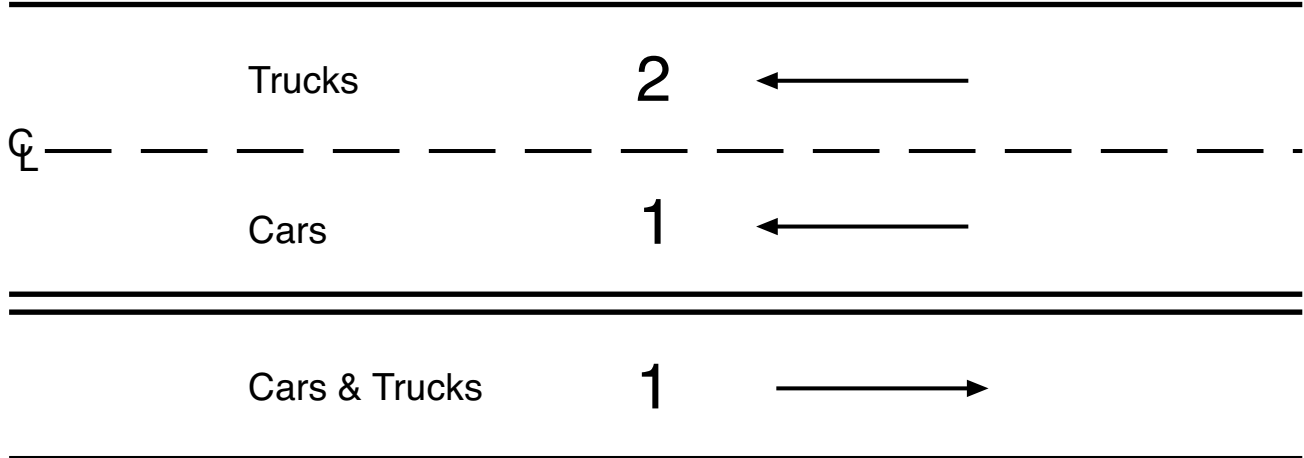
**2. 4-Lane Undivided**



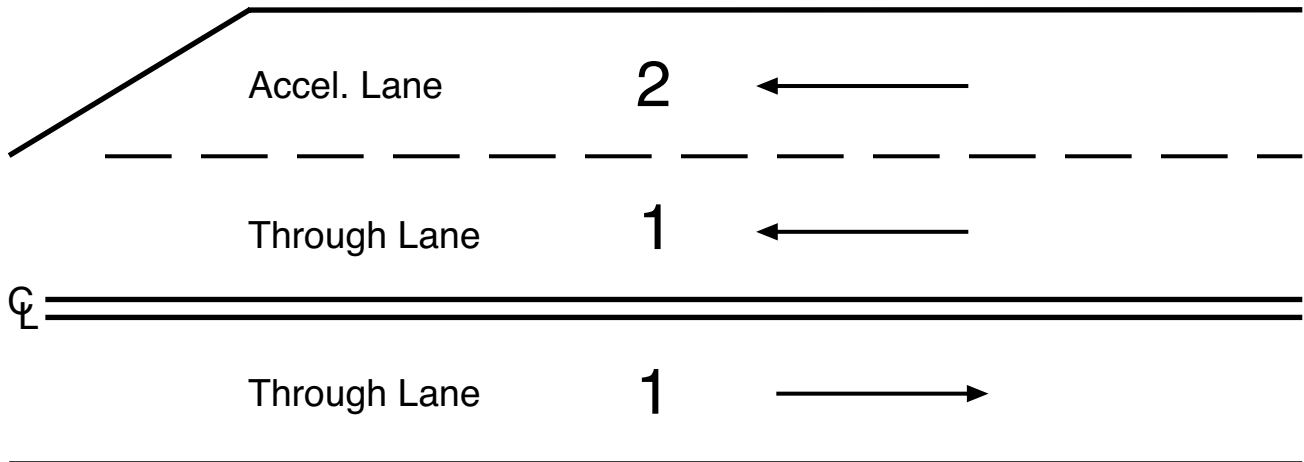
**3. 4-Lane Divided**

The lanes are numbered the same as 4-lane undivided

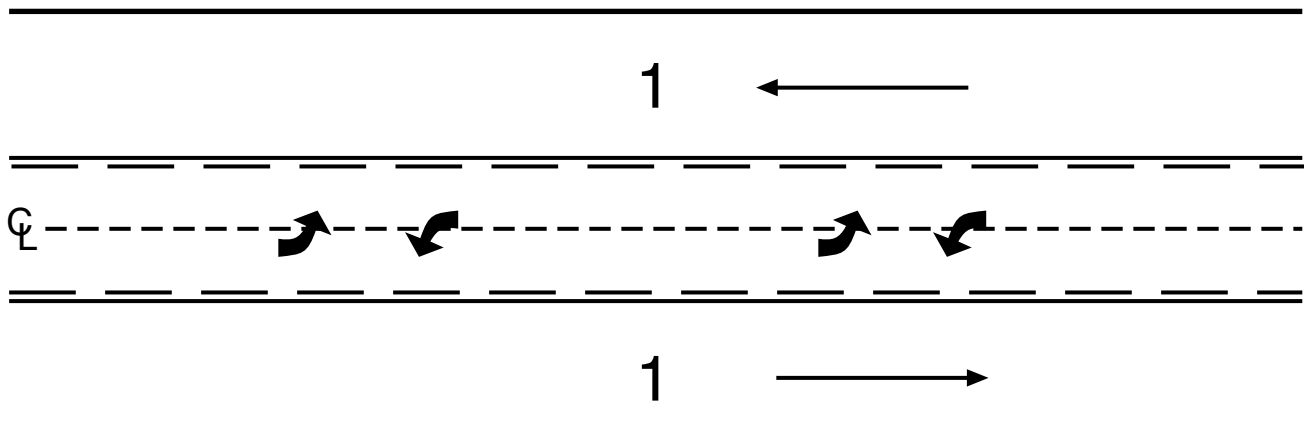
**4. Truck-Climbing Lane-Number only if more than 1/2 mile long**



**5. Acceleration/Deceleration Lane-Number only if more than 1/2 mile long**



**6. 2-Way Left Turn Lane-not included on # of lanes and is not rated  
It has no lane number.**



# RATING AREA LAYOUT

## Cumulative Mile

The rating area is identified as a specific location between two “cumulative miles” on a route within a county. These are identified as the “FROM CUMMILE” and the “TO CUMMILE”. The written description should be used to establish these beginning and ending points.

In most instances, the cumulative miles will correspond to the milepost panels located in the field.

## Rating Areas

Rating areas, in most instances, are located 1/10th of a mile beyond the “FROM CUMMILE” in the direction of travel. The rating area is to be 100 feet in length and 10 feet in width for a total of 1000 square feet. The rating area shall encompass both wheelpaths of the test lane. All distress measurements are made within this rating area. (See Figure 20)

If the "cummile" does not match the milepost panel in the field the rating area will need to be established based on the "cummile" **not** the milepost panel. (see Figure 20A)

In isolated cases, the milepost panels in the field may not reflect the newest route identification number. In this case, the route identification number listed on the pavement condition rating form should be used and notes should be made on the form to make the Materials Division aware what is currently shown in the field.

Figure 20 . Rating Area Layout for  
"Cummile" Matching Milepost Panels

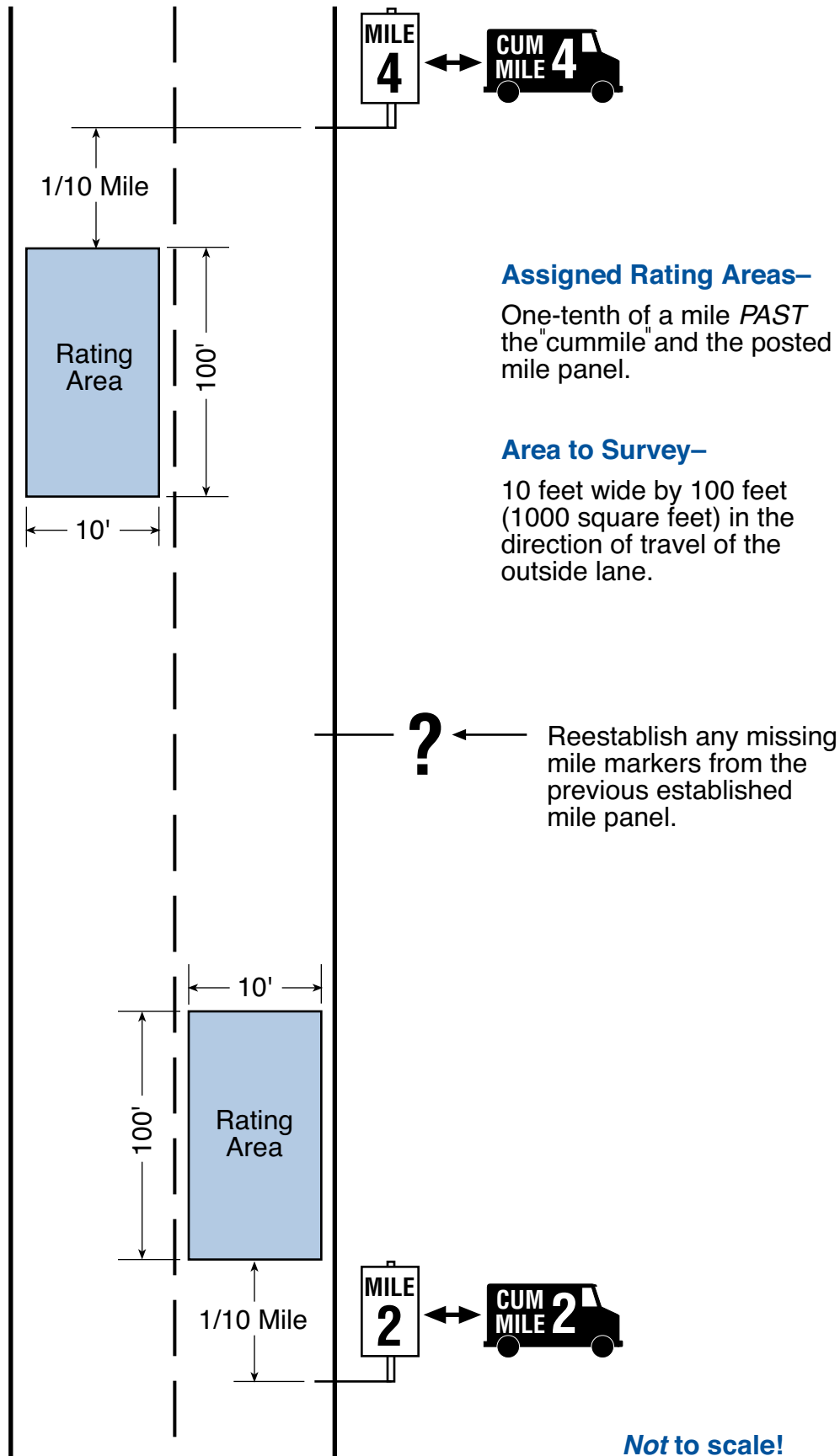
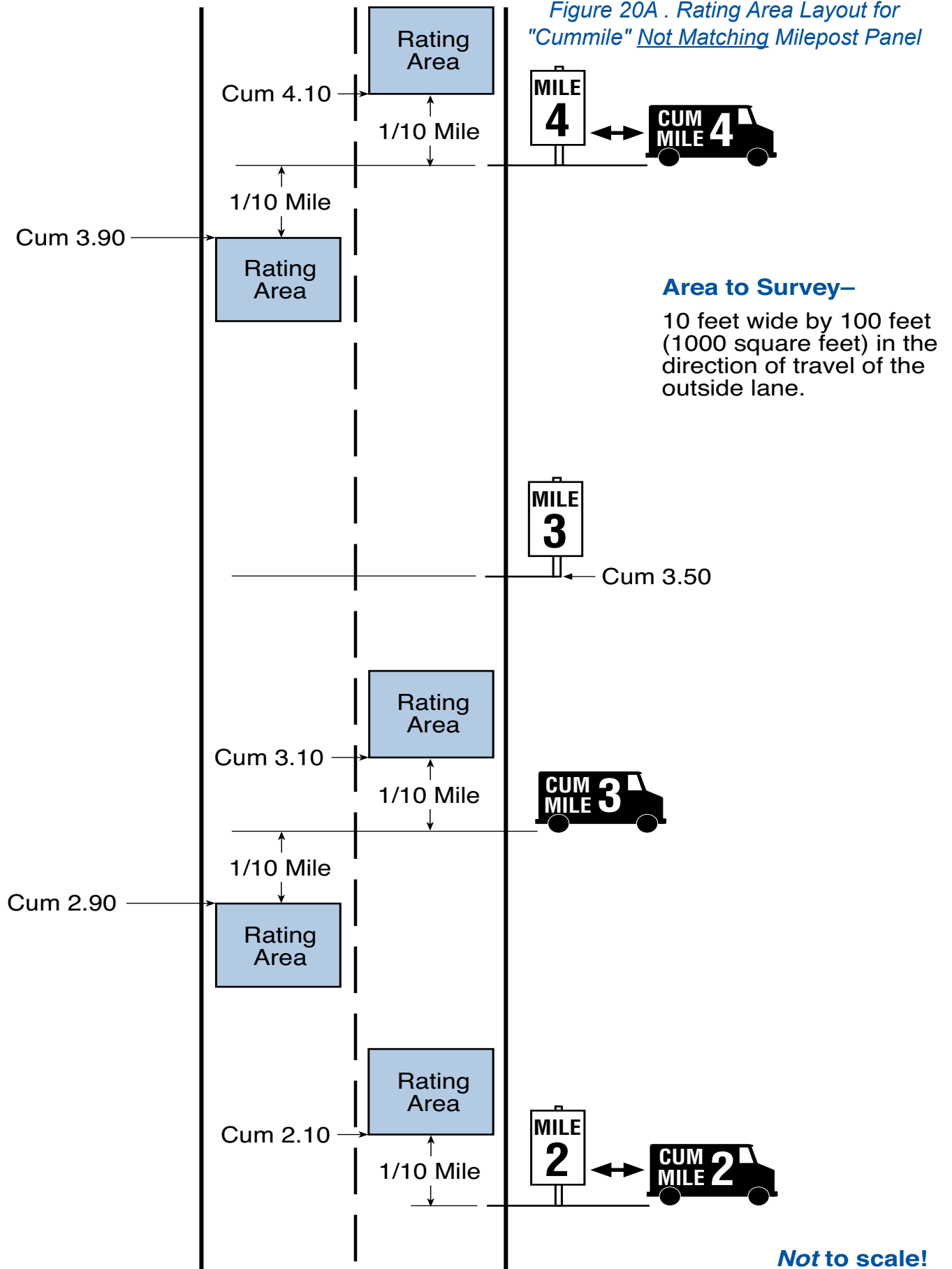


Figure 20A . Rating Area Layout for  
"Cummile" Not Matching Milepost Panel



**Not to scale!**



## Flexible Pavement Condition Rating Form

*The Flexible Pavement Condition Rating Form contains the information necessary to locate the rating areas. It is also where the raters record the information gathered during the distress survey.*

# Flexible Pavement Condition Rating Form

## The Header:

**A The Heading**

STATE OF NEVADA  
DEPARTMENT OF TRANSPORTATION  
MATERIALS DIVISION  
PAVEMENT CONDITION RATING FORM

**B CREW-NO**

Indicates which Maintenance crew is responsible for that particular section of the roadway.

**C FLEXIBLE PAVEMENT**

Indicates what type of pavement is being rated.

**D DISTRICT:**

Identifies the rating area District.

**E COUNTY:**

Identifies the rating area County.

**F ROUTE:**

Identifies the rating area Route.

**G** Description of the section of the road to be rated, i.e.  
'SUNNYSIDE CUTOFF FROM US093 TO A MAINTENANCE BOUNDARY AT  
CUMMILE 43.72 (DISTRICT 1/3 BOUNDARY)'

**H PAGE**

The number of the "print-out" page.

**I DATE**

The date the condition form was printed.

**J The Body of the Form**

The pre-printed rating area location and the entry form for the condition rater.

**A** STATE OF NEVADA  
DEPARTMENT OF TRANSPORTATION  
MATERIALS DIVISION  
PAVEMENT CONDITION RATING FORM

**B** CREW NO: 122 **C** **E** **F**  
FLEXIBLE PAVEMENT  
**D** DISTRICT: 1 COUNTY: LN ROUTE: SR318

**H** PAGE: 1  
**I** DATE: 12/01/2006

**G** SUNNYSIDE CUTOFF FROM US093 TO A MAINTENANCE BOUNDARY AT CUMMILE 43.72 (DISTRICT 1/3 BOUNDARY)

FROM CUM MILE	TO CUM MILE	DIR	# OF LANES	TEST LANE	TESTED CUM MILE	TEST DATE	CRACKING						RUT > OR = 1/2"	PATCH Sq Ft	FLUSH L.M.S	RAVEL L.M.S	PAVE COND PICT			
							LONGITUDINAL			TRANSVERSE								BLOCK		CRCK SEAL
							FATIGUE T	SEV	EXT	NON-WHEEL SEV	EXT	SEV						EXT	T	
0.00	1.00	N	1	1	0.10															
COMMENT:																				
1.00	2.00	N	1	1	1.10															
COMMENT:																				
2.00	3.00	N	1	1	2.10															
COMMENT:																				
3.00	4.00	N	1	1	3.10															
COMMENT:																				
4.00	5.00	N	1	1	4.10															
COMMENT:																				
5.00	6.00	N	1	1	5.10															
COMMENT:																				
6.00	7.00	N	1	1	6.10															
COMMENT:																				
7.00	8.00	N	1	1	7.10															
COMMENT:																				
8.00	9.00	N	1	1	8.10															
COMMENT:																				
9.00	10.00	N	1	1	9.10															
COMMENT:																				

NAME OF RATERS: \_\_\_\_\_

Maximum Extent Notes  
FATIGUE  
A - 200 LN FT  
B - 600 SQ FT

NON WHEEL  
300 LN FT

TRANSVERSE  
210 LN FT

BLOCK  
A - 510 LN FT  
B - 1000 SQ FT  
C - 1000 SQ FT

Figure 21. Condition Rating Form

## The Footer:

### **K** NAME OF RATERS:

Area where the names of the individuals doing the pavement ratings are entered.

## The Body:

### Preprinted Information Columns:

<u>Column</u>	<u>Label</u>	<u>Description</u>
<b>1</b>	<b>FROM “CUMMILE”</b>	This column is pre-printed with the <b>From “Cummile”</b> . This is the beginning of the rating segment in which the rating area is located.
<b>2</b>	<b>TO “CUMMILE”</b>	This column is pre-printed with the <b>To “Cummile”</b> . This is the ending of the rating segment in which the rating area is located.
<b>3</b>	<b>DIR</b>	This column is pre-printed with the <b>Direction</b> of travel on the route in which the rating area is located.
<b>4</b>	<b># OF LANES</b>	This column is pre-printed with the <b>Number of Lanes</b> , in <i>that particular direction of travel</i> , on that route. If this number does not correspond to the actual number of lanes, the rater is to cross-out the existing preprinted number, write in the correct number of lanes, and write a comment explaining the change in the space between rating sections on the condition rating form.
<b>5</b>	<b>TEST LANE</b>	This column is pre-printed with the <b>Lane Number</b> in which the rating area is to be located (refer to Chapter 3, Lane Identification and Numbering, and Rating Area Layout, if necessary). The lane to be rated is <i>usually</i> the most heavily traveled lane and is <i>traditionally</i> the outer most lane. If the preprinted lane number does not correspond to the rated lane number, the rater should correct the form by crossing out the existing number, entering the actual rated lane number and writing a comment explaining the change on the condition rating form in the space between rating sections.

**STATE OF NEVADA  
DEPARTMENT OF TRANSPORTATION  
MATERIALS DIVISION  
PAVEMENT CONDITION RATING FORM**

CREW NO: 122  
FLEXIBLE PAVEMENT  
DISTRICT: 1 COUNTY: LN ROUTE: SR318  
PAGE: 1  
DATE: 12/01/2006

SUNNYSIDE CUTOFF FROM US093 TO A MAINTENANCE BOUNDARY AT CUMMILE 43.72 (DISTRICT 1/3 BOUNDARY)

CRACKING																
FROM CUM MILE	TO CUM MILE	# OF LANES	TEST DATE	LONGITUDINAL			TRANSVERSE			BLOCK	CRCK SEAL	RUT > OR = 1/2"	PATCH Sq Ft	FLUSH L,M,S	RAVEL L,M,S	PAVE COND PICT
				FATIGUE T	SEV	EXT	NON-WHEEL SEV	EXT	SEV							
0.00	1.00	N 1	1	0.10												
COMMENT:																
1.00	2.00	N 1	1	1.10												
COMMENT:																
2.00	3.00	N 1	1	2.10												
COMMENT:																
3.00	4.00	N 1	1	3.10												
COMMENT:																
4.00	5.00	N 1	1	4.10												
COMMENT:																
5.00	6.00	N 1	1	5.10												
COMMENT:																
6.00	7.00	N 1	1	6.10												
COMMENT:																
7.00	8.00	N 1	1	7.10												
COMMENT:																
8.00	9.00	N 1	1	8.10												
COMMENT:																
9.00	10.00	N 1	1	9.10												
COMMENT:																

**K** NAME OF RATERS: \_\_\_\_\_

Maximum Extent Notes

FATIGUE	NON WHEEL	TRANSVERSE	BLOCK
A - 200 LN FT	300 LN FT	210 LN FT	A - 510 LN FT
B - 600 SQ FT			B - 1000 SQ FT
			C - 1000 SQ FT

Figure 22. Condition Rating Form

<u>Column</u>	<u>Label</u>	<u>Description</u>
<b>6</b>	<b>TESTED “CUMMILE”</b>	This column is pre-printed with the <i>exact beginning</i> point of the rating area and is referred to as the <b>Tested Cummile</b> . In <i>most cases</i> the rating area is located one-tenth (0.1) of a mile <i>beyond</i> the “From Cummile”. In urban areas exceptions to this rule are more common because of the locations of intersections, interchanges, bridges, roadway configurations, traffic flow, and <i>safety</i> concerns. However, there are some rating areas in urban areas that do conform to the normal layout. <b>Always refer to this column to correctly identify the beginning of each rating area.</b>

The rating areas have been established and adjusted to take into account the above mentioned concerns. However, if for some reason the rating area must be moved from the location printed on the condition rating form, the rater should correct the form. This is done by crossing out the location printed on the form, entering the exact beginning point of the new rating area, and writing a comment explaining the change on the condition rating form in the space between rating sections.

**It is very important that the rating areas are not relocated unless it is absolutely necessary!** All *historical data* has been recorded from the location printed on the form. The historical data is analyzed and charted to show the rate of deterioration of a particular area to help determine the proper rehabilitation strategy. When the areas are moved the integrity of the historical database may become threatened. This in turn can affect decisions made from the use of the data.

## Data Entry Columns:

<u>Column</u>	<u>Label</u>	<u>Description</u>
<b>7</b>	<b>TEST DATE</b>	This is the column where the rater is to enter the <b>Date</b> the pavement condition rating is completed on that particular rating area. The date entered in this column should be the <i>numeric date</i> beginning with the month, followed by the day and the year (i.e. 05-23-07). If all the rating areas on that page are rated <i>on the same day</i> it is permissible to enter that day’s date in the first box and then draw a line vertically down through the remaining boxes to the last rating area tested. Dates <i>must</i> be entered on each individual rating sheet.

**STATE OF NEVADA  
DEPARTMENT OF TRANSPORTATION  
MATERIALS DIVISION  
PAVEMENT CONDITION RATING FORM**

CREW NO: 122  
FLEXIBLE PAVEMENT  
DISTRICT: 1 COUNTY: LN ROUTE: SR318

SUNNYSIDE CUTOFF FROM US093 TO A MAINTENANCE BOUNDARY AT CUMMILE 43.72 (DISTRICT 1/3 BOUNDARY)

**6** CRACKING

FROM CUM MILE	TO CUM MILE	DIR	# OF LANES	TEST LANE	TESTED CUM MILE	TEST DATE	LONGITUDINAL				TRANSVERSE			BLOCK			CRK SEAL	RUT > OR = 1/2"	PATCH Sq Ft	FLUSH L,M,S	RAVEL L,M,S	COND PICT	PAVE PICT
							FATIGUE T	SEV	EXT	NON-WHEEL SEV	EXT	SEV	EXT	T	SEV	EXT							
0.00	1.00	N	1	1	0.10	<b>7</b>																	

COMMENT:

1.00	2.00	N	1	1	1.10																		
------	------	---	---	---	------	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

COMMENT:

2.00	3.00	N	1	1	2.10																		
------	------	---	---	---	------	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

COMMENT:

3.00	4.00	N	1	1	3.10																		
------	------	---	---	---	------	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

COMMENT:

4.00	5.00	N	1	1	4.10																		
------	------	---	---	---	------	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

COMMENT:

5.00	6.00	N	1	1	5.10																		
------	------	---	---	---	------	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

COMMENT:

6.00	7.00	N	1	1	6.10																		
------	------	---	---	---	------	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

COMMENT:

7.00	8.00	N	1	1	7.10																		
------	------	---	---	---	------	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

COMMENT:

8.00	9.00	N	1	1	8.10																		
------	------	---	---	---	------	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

COMMENT:

9.00	10.00	N	1	1	9.10																		
------	-------	---	---	---	------	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

COMMENT:

NAME OF RATERS: \_\_\_\_\_

Maximum Extent Notes

FATIGUE

A - 200 LN FT  
B - 600 SQ FT

NON WHEEL

300 LN FT

TRANSVERSE

210 LN FT

BLOCK

A - 510 LN FT  
B - 1000 SQ FT  
C - 1000 SQ FT

Figure 23. Condition Rating Form

# CRACKING

## LONGITUDINAL

### FATIGUE

<u>Column</u>	<u>Label</u>	<u>Description</u>
8	T	This column is where the rater enters the <b>Type</b> of <b>Fatigue Cracking</b> . The entry in this column is either “A”, “B” or left empty if there is no Fatigue type cracking in the rating area (refer to Chapter 2, Flexible Pavement Distress).
9	SEV	This column is where the rater enters the <b>Severity</b> (average crack width) of the <b>Type</b> of <b>Fatigue Cracking</b> identified in column 8. The column should remain blank if no Fatigue cracking exists.
10	EXT	This column is where the rater enters the <b>Extent</b> (linear feet if Type A, square feet if Type B) of the <b>Type</b> of <b>Fatigue Cracking</b> identified in column 8. The column should remain blank if no Fatigue Cracking exists. Fatigue Type “A” cracking can be a maximum of 200 linear feet (100 foot rating area length x 2 wheelpaths). Fatigue Type “B” cracking can be a maximum of 600 square feet (100 foot rating area length x 3 foot wheelpath width x 2 wheelpaths).

### NON-WHEELPATH

11	SEV	This column is where the rater enters the <b>Severity</b> (average crack width) of <b>Non-Wheelpath Longitudinal Cracking</b> . The column should be left empty if no Non-Wheelpath Longitudinal cracking exists.
12	EXT	This column is where the rater enters the <b>Extent</b> (linear feet) of <b>Non-Wheelpath Longitudinal Cracking</b> . The column should be left empty if no Non-Wheelpath Longitudinal Cracking exists. The maximum value is 300 linear feet (100 foot rating area length x 3 non wheel path areas).

**STATE OF NEVADA  
DEPARTMENT OF TRANSPORTATION  
MATERIALS DIVISION  
PAVEMENT CONDITION RATING FORM**

CREW NO: 122  
FLEXIBLE PAVEMENT  
DISTRICT: 1 COUNTY: LN ROUTE: SR318

PAGE: 1  
DATE: 12/01/2006

SUNNYSIDE CUTOFF FROM US093 TO A MAINTENANCE BOUNDARY AT CUMMILE 43.72 (DISTRICT 1/3 BOUNDARY)

FROM CUM MILE		TO CUM MILE		# OF LANES	TEST DATE	CRACKING										RUT > OR = 1/2"	PATCH Sq Ft	FLUSH L,M,S	RAVEL L,M,S	COND PICT			
						LONGITUDINAL					TRANSVERSE										BLOCK		CRCK SEAL
						FATIGUE		NON-WHEEL			SEV		EXT								T	SEV	
T	SEV	EXT	SEV	EXT	SEV	EXT	SEV	EXT	SEV	EXT	T	SEV	EXT										
0.00	1.00	N	1	1	0.10																		
COMMENT:																							
1.00	2.00	N	1	1	1.10																		
COMMENT:																							
2.00	3.00	N	1	1	2.10																		
COMMENT:																							
3.00	4.00	N	1	1	3.10																		
COMMENT:																							
4.00	5.00	N	1	1	4.10																		
COMMENT:																							
5.00	6.00	N	1	1	5.10																		
COMMENT:																							
6.00	7.00	N	1	1	6.10																		
COMMENT:																							
7.00	8.00	N	1	1	7.10																		
COMMENT:																							
8.00	9.00	N	1	1	8.10																		
COMMENT:																							
9.00	10.00	N	1	1	9.10																		
COMMENT:																							

NAME OF RATERS: \_\_\_\_\_

Maximum Extent Notes

FATIGUE	NON WHEEL	TRANSVERSE	BLOCK
A - 200 LN FT	300 LN FT	210 LN FT	A - 510 LN FT
B - 600 SQ FT			B - 1000 SQ FT
			C - 1000 SQ FT

Figure 24. Condition Rating Form

## TRANSVERSE

<u>Column</u>	<u>Label</u>	<u>Description</u>
13	SEV	This column is where the rater enters the <b>Severity</b> (average crack width) of <b>Transverse Cracking</b> . The column should remain empty if no Transverse cracking exists.
14	EXT	This column is where the rater enters the <b>Extent</b> (linear feet) of <b>Transverse Cracking</b> . The column should remain empty if no Transverse Cracking exists. The maximum value is 210 linear feet (21 maximum cracks x 10 foot wide rating area – based on one crack every 5 feet).

## BLOCK

15	T	This column is where the rater enters the <b>Type of Block Cracking</b> . The possible entrees in this column are “A”, “B”, or “C”. The column should remain empty if no Block type cracking exists (refer to Chapter 2, Flexible Pavement Distress).
16	SEV	This column is where the rater enters the <b>Severity</b> (average crack width) of the <b>Type of Block Cracking</b> identified in column 15. The column should remain empty if no Block cracking exists.
17	EXT	This column is where the rater enters the <b>Extent</b> (linear feet if Type A, square feet if Type B or C) of the <b>Type of Block Cracking</b> identified in column 15. The column should remain empty if no Block Cracking exists. The maximum value for Block Cracking Type A is 510 linear feet (300 feet of non wheel path longitudinal cracking + 210 feet of transverse cracking). The maximum value for Block Cracking Types B and C are 1000 square feet (100 foot rating area length x 10 foot rating area width).

**STATE OF NEVADA  
DEPARTMENT OF TRANSPORTATION  
MATERIALS DIVISION  
PAVEMENT CONDITION RATING FORM**

CREW NO: 122

FLEXIBLE PAVEMENT

DISTRICT: 1 COUNTY: LN ROUTE: SR318

PAGE: 1

DATE: 12/01/2006

SUNNYSIDE CUTOFF FROM US093 TO A MAINTENANCE BOUNDARY AT CUMMILE 43.72 (DISTRICT 1/3 BOUNDARY)

FROM CUM MILE		TO CUM MILE		# OF LANES	TEST DATE	CRACKING						CRCK SEAL	RUT > OR = 1/2"	PATCH Sq Ft	FLUSH L,M,S	RAVEL L,M,S	PAVE COND PICT
						LONGITUDINAL		TRANSVERSE		BLOCK							
		FATIGUE		NON-WHEEL		SEV		EXT		T		SEV		EXT			
		T	SEV	EXT	SEV	EXT	SEV	EXT	T	SEV	EXT						
0.00	1.00	N	1	1	0.10												
COMMENT:																	
1.00	2.00	N	1	1	1.10												
COMMENT:																	
2.00	3.00	N	1	1	2.10												
COMMENT:																	
3.00	4.00	N	1	1	3.10												
COMMENT:																	
4.00	5.00	N	1	1	4.10												
COMMENT:																	
5.00	6.00	N	1	1	5.10												
COMMENT:																	
6.00	7.00	N	1	1	6.10												
COMMENT:																	
7.00	8.00	N	1	1	7.10												
COMMENT:																	
8.00	9.00	N	1	1	8.10												
COMMENT:																	
9.00	10.00	N	1	1	9.10												
COMMENT:																	

NAME OF RATERS: \_\_\_\_\_

Maximum Extent Notes

FATIGUE	NON WHEEL	TRANSVERSE	BLOCK
A - 200 LN FT	300 LN FT	210 LN FT	A - 510 LN FT
B - 600 SQ FT			B - 1000 SQ FT
			C - 1000 SQ FT

Figure 25. Condition Rating Form

<u>Column</u>	<u>Label</u>	<u>Description</u>
<b>18</b>	<b>CRCK SEAL</b>	<p>This column is where the rater enters an indicator acknowledging the existence of <b>Crack Seal</b>. The possible entries are “Y” for Yes, “N” for No or if there are no cracks in the rating area, the column should remain empty.</p> <p>Entering <i>"Y"</i> indicates that <i>eighty-five percent (85%) or more</i> of the cracks within the rating area have been sealed <i>and</i> that the sealant is in <i>good condition</i>. This means that the sealant has not dried, cracked and/or separated from the walls of the cracks and <i>will not</i> allow water and debris to enter those cracks.</p> <p>Entering <i>"N"</i> indicates <i>that</i> there is either <i>NO sealant</i>, the existing cracks are <i>less than eighty-five percent (85%) sealed</i>, or that the <i>existing sealant is in poor condition and does not</i> meet the criteria stated above in the <i>"Y"</i> category.</p>
<b>19</b>	<b>RUT &gt;OR= 1/2"</b>	<p>This column is where the rater enters an indicator acknowledging the existence of <b>severe Rutting</b>. The possible entries are “Y” for Yes or “N” for No. A “Y” indicates that the existing rutting is 1/2 inch or more. An “N” indicates that either no rutting exists or that the existing rutting is less than 1/2 inch. The depth of rutting is left up to the judgment of the raters.</p>
<b>20</b>	<b>PATCH</b>	<p>This column is where the rater enters the amount of <b>Patching</b> existing in the rating area in square feet. If no patching exists, the column should remain empty. The total amount of patching <i>may</i> cover the entire rating area, or 1000 square feet (100 foot rating area length x 10 foot rating area width).</p>
<b>21</b>	<b>FLUSH</b>	<p>This column is where the rater enters the degree of severity of the <b>Flushing</b> present in the rating area. If flushing exists, the rater selects the <i>picture</i>, from Pictures 17, 18, and 19 in Chapter 7, that best represents the severity of the flushing and enters its corresponding severity level (<i>"L" for low, "M" for moderate, or "S" for severe</i>) in <i>column number 21</i> of the condition rating form. If no flushing exists within the rating area then the column should remain empty.</p>
<b>22</b>	<b>RAVEL</b>	<p>This column is where the rater enters the degree of severity of the <b>Raveling</b> present in the rating area. If raveling exists, the rater selects the <i>picture</i>, from Pictures 20, 21, and 22 in Chapter 7, that best represents the severity of the raveling and enters its corresponding severity level (<i>"L" for low, "M" for moderate, or "S" for severe</i>) in <i>column number 22</i> of the condition rating form. If no raveling exist within the rating area then the column should remain empty.</p>



<u>Column</u>	<u>Label</u>	<u>Description</u>
<b>23</b>	<b>PAVE COND PICT</b>	<p>This column is where the rater enters a number corresponding to the photograph that best represents the <i>Pavement Condition</i> of the rating area. The Rater compares the condition of the roadway to the <i>pictures</i> numbered <i>one (1) through twenty-two (22)</i>, found in Chapter 7, Pavement Condition Photographs, and picks the picture <i>that most closely represents</i> that rating area's overall pavement condition. That picture number is then entered into <i>column number 23</i> of the condition rating form.</p>

***NOTE!*** There is *always* a picture number entered in this column! There can be *only one (1)* picture number entered.

**STATE OF NEVADA  
DEPARTMENT OF TRANSPORTATION  
MATERIALS DIVISION  
PAVEMENT CONDITION RATING FORM**

CREW NO: 122

FLEXIBLE PAVEMENT

DISTRICT: 1 COUNTY: LN ROUTE: SR318

PAGE: 1

DATE: 12/01/2006

SUNNYSIDE CUTOFF FROM US093 TO A MAINTENANCE BOUNDARY AT CUMMILE 43.72 (DISTRICT 1/3 BOUNDARY)

FROM CUM MILE	TO CUM MILE	DIR	# OF LANES	TEST LANE	TESTED CUM MILE	TEST DATE	CRACKING										RUT > OR = 1/2"	PATCH Sq Ft	FLUSH L,M,S	RAVEL L,M,S	PAVE COND PICT
							LONGITUDINAL			TRANSVERSE			BLOCK								
							FATIGUE T	SEV	EXT	NON-WHEEL SEV	EXT	SEV	EXT	T	SEV	EXT					
0.00	1.00	N	1	1	0.10														23		
COMMENT:																					
1.00	2.00	N	1	1	1.10																
COMMENT:																					
2.00	3.00	N	1	1	2.10																
COMMENT:																					
3.00	4.00	N	1	1	3.10																
COMMENT:																					
4.00	5.00	N	1	1	4.10																
COMMENT:																					
5.00	6.00	N	1	1	5.10																
COMMENT:																					
6.00	7.00	N	1	1	6.10																
COMMENT:																					
7.00	8.00	N	1	1	7.10																
COMMENT:																					
8.00	9.00	N	1	1	8.10																
COMMENT:																					
9.00	10.00	N	1	1	9.10																
COMMENT:																					

NAME OF RATERS: \_\_\_\_\_

Maximum Extent Notes

FATIGUE	NON WHEEL	TRANSVERSE	BLOCK
A - 200 LN FT	300 LN FT	210 LN FT	A - 510 LN FT
B - 600 SQ FT			B - 1000 SQ FT
			C - 1000 SQ FT

Figure 27. Condition Rating Form



## Tools of the Trade

*This Chapter discusses the tools used during the flexible pavement distress survey.*

# Crack Width Gauge:

The “**Crack Width Gauge**” is a plastic laminated card, with a scale printed on its face, used to measure the widths of the distress cracking found within the rating areas. The gauge is divided into one-eighth (1/8) inch increments and has the capacity to measure up to two and one-half (2-1/2) inch width cracks (see sample below).

To properly use this gauge, simply place the “0” mark at one side of the crack being measured and read the number that falls at the other side of the crack edge. That number indicates the width, in *eighths of an inch increments*, of the crack at that spot along the crack. All fractions of measurements should be "rounded" to the nearest 1/8 inch increment.

Remember to take at least six measurements at different locations along the distress being measured and to average those measurements. The average of those measurements is entered on to the rating form in the appropriate *Severity* column(s).

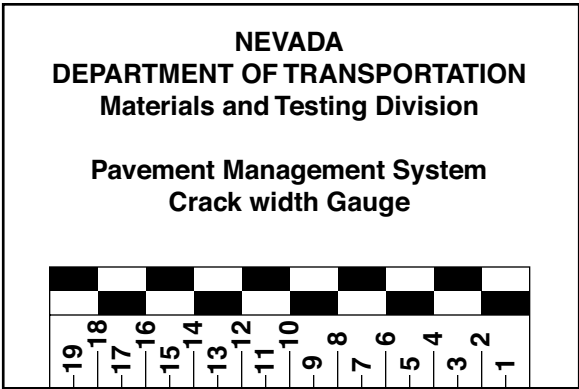


Figure 28. Crack Width Gauge

## Definitions of Key Terms

*Terms commonly used in this manual*

### **Acceleration lane -**

A lane constructed to allow for the *safe merging* of traffic on to the mainline.

### **Block Cracking -**

Type “A” - the *intersecting of both longitudinal and transverse cracks* which form *large block patterns* measuring *5 feet x 5 feet or larger*.

Type “B” - a development of *interconnecting cracks* which *form a series of polygons*, usually with sharp corners. This distress pattern has the appearance of big "chicken wire" and is due to the aging and hardening of the pavement. The size of the polygons range from *1 feet x 1 feet to 5 feet x 5 feet*.

Type “C” - a development of *interconnected cracks* which *form a series of small polygonal shaped sections* with sharp corners. This pattern resembles ‘chicken wire’ in its appearance and is limited to a size of *not more than 1 foot x 1 foot*. This distress is due to the aging and hardening of the pavement and a further deterioration of Type “B” Block Cracking.

### **Condition Rating Form -**

A computer generated form on which the field gathered pavement distress data is recorded (See Chapter 4, Flexible Pavement Condition Rating Form).

### **Crack Width Gauge -**

A measuring device used to measure the width of pavement cracks (see Chapter 5, Tools of the Trade).

### **Deceleration Lane -**

A lane constructed to allow for the *safe departure* of traffic off of the mainline.

### **Direction -**

The direction in which the traffic flows on any travelway.

### **Extent of Distress -**

The *measurement of pavement distress* found within the rating area. Depending on the type of distress either lineal or square footage is used as a measurement.

### **Fatigue Cracking -**

Type “A” - a *single longitudinal crack, located in the wheelpath(s)*, which runs near parallel to the centerline of the roadway. This type of crack is stress and load related and is the first indicator of pavement fatigue.

Type “B” - a series of *interconnected longitudinal fatigue cracks located in the wheelpath(s)*. These cracks form a "alligator skin" type pattern and are the worsening of the fatigue of the pavement. This distress is due to the *continued loading* and *stresses* on the pavement.

**Flushing -**

The presence of *asphaltic binder (oil) found at the pavement's surface*, usually in the wheelpath area.

**Highway Number -**

The *roadway identification number* assigned to a particular travelway.

**Lane Identification Number -**

A *number assigned to the individual lanes of the travelway*. The number sequence is repeated for each direction of travel on the roadway.

**Non-Wheelpath Longitudinal Cracking -**

Longitudinal cracking in the pavement surface, predominately *parallel to the centerline, located outside the wheelpaths*.

**Pavement Condition Survey -**

The rating of the current surface condition of the State's flexible pavement roadways.

**Patching -**

The *temporary repair(s)* to the pavement surface to correct roadway irregularities.

**Pot Hole -**

Bowl shaped depressions of various sizes in the pavement surface. Potholes generally start to develop as small localized spots of fatigue cracking or surface disintegration. Traffic loads dislodge and pop out small pieces of asphalt and base.

**Rating Area -**

The section of the roadway in which the pavement distress identification and measurements are taken.

**Rating Segment -**

A section of roadway usually 1 mile in length in which a rating area is located. It is defined by the "From Cummmile" and the "To Cummmile".

**Raveling -**

The aging, weathering and wearing away of the roads surface asphaltic binder allowing the aggregate to loosen and become worn away by traffic.

**Rut Depth -**

The measurement of the pavements depression in the wheelpath area caused by traffic loading.

**Severity -**

The average crack width of a particular type of pavement distress.

**Shoving -**

Lateral movement of asphalt pavement away from the wheelpath area causing bulging in the pavement surface.

**Spalling -**

The cracking or breaking of the crack edges.

**Stripping -**

The weakening or eventual loss of the adhesive bond, usually in the presence of moisture, between the aggregate surface and the asphalt cement in a hot mix asphalt pavement or mixture.

**Tested “Cummile” -**

The point at which the beginning of the rating area is located.

**Test Lane -**

The individual lane in which the distress rating is to be conducted.

**Transverse Cracking -**

Transverse cracks, *near perpendicular to the centerline*, running across the roads surface.

**Truck Lane(s) -**

A travel lane specially constructed to carry uphill truck traffic.

**Type -**

The identification of the distress category.

## Pavement Condition Photographs

*These photographs are used to identify the overall condition of the roadway. The number of the photograph which best depicts the condition of the roadway will be entered in column number 23 of the Condition Rating Form.*



*Picture 1. Good Pavement.*



*Picture 2. Fatigue Cracking Type A. Cracks in One or Both Wheelpaths.*



*Picture 3. Fatigue Cracking Type A with some Type B.*



*Picture 4. Fatigue Cracking Type B. Cracking in One or Both Wheelpaths.*



*Picture 5. Fatigue Cracking Type B with Potholes.*





*Picture 7. Transverse Cracking.*



*Picture 8. Non-Wheelpath Longitudinal and Transverse Cracks Sealed.*



*Picture 9. Block Cracking Type A.*



*Picture 10. Block Cracking Type B.*



*Picture 11. Block Cracking Type C.*



*Picture 12. Block Cracking, Potholing and Patching.*



*Picture 13. Rutting.*



*Picture 14. Rutting and Shoving.*



*Picture 15. Patching.*



*Picture 16. Washboard Pavement.*



*Picture 17. Low Flushing.*



*Picture 18. Moderate Flushing.*



*Picture 19. Severe Flushing.*



*Picture 20. Low Raveling.*



*Picture 21. Moderate Raveling.*

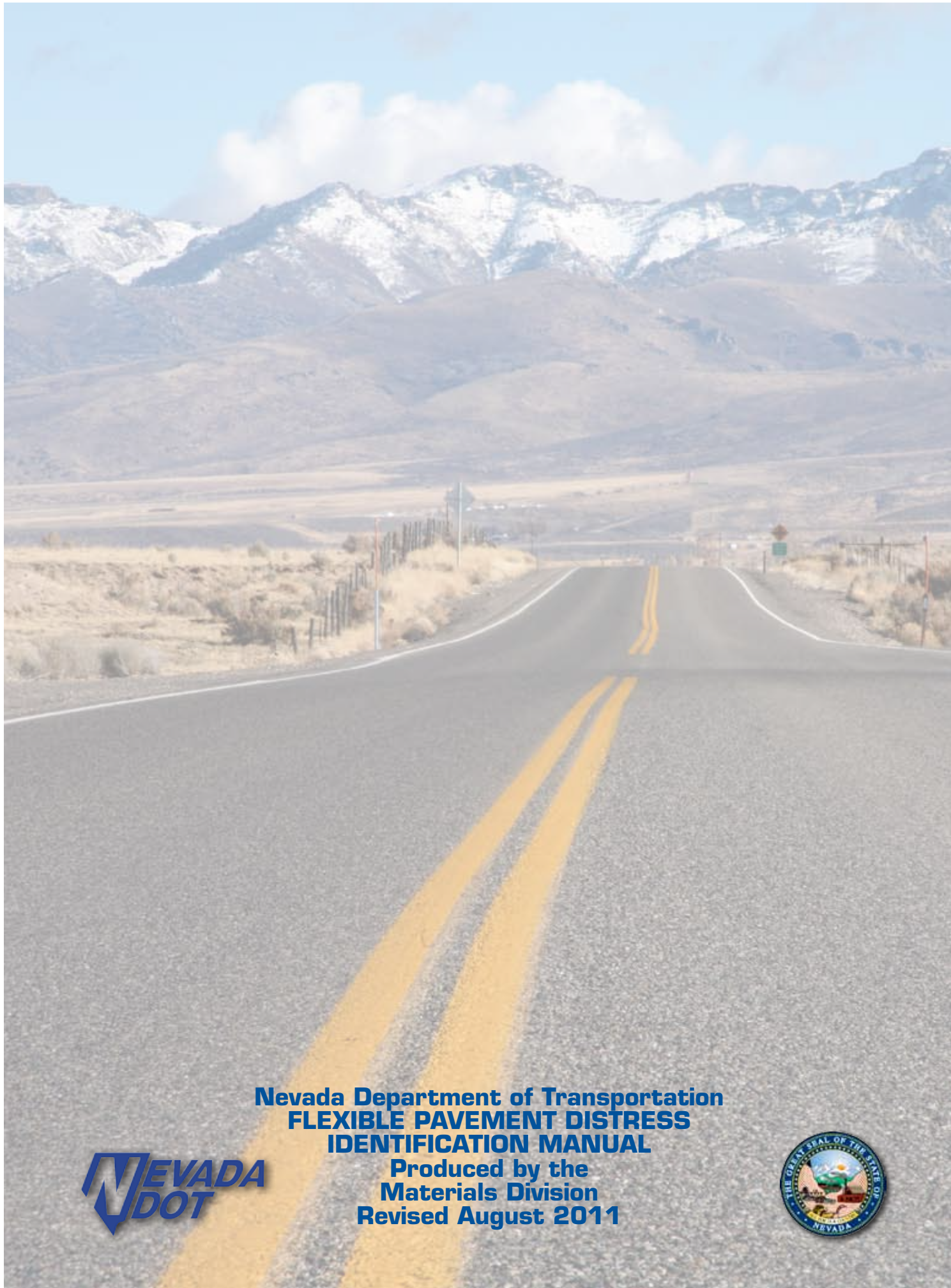


*Picture 22. Severe Raveling.*

# NOTES

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**Nevada Department of Transportation  
FLEXIBLE PAVEMENT DISTRESS  
IDENTIFICATION MANUAL**

**Produced by the  
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